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How About Air Conditioning For Farm Homes?

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how about AIR CONDITIONING for farm homes?

With the approach of summer, we've asked Prof. John F. Sandfort, of the Department of Mechanical Engineering at Iowa State College, to answer some of the questions most frequently asked about home air conditioning.

by John F. Sandfort

CORN WEATHER is fine for corn. But the hot, humid weather which may be so good for the corn crop doesn't always make us feel good. Here are the answers to typical questions being asked about air conditioning in Iowa homes.

We're thinking of air conditioning our home. What special problems should we consider?

People around the country are becoming more and more conscious of the desirability of air conditioning their homes. This is largely due to greatly increased sales promotion activity by the various manufacturers. They feel that the time is ripe for the development of the mass residential market. This, in turn, is due to the generally high level of consumer purchasing power and the present state of the technology in this field.

However, this widespread interest, combined with a highly competitive sales situation, has resulted in many misleading impressions. Be very careful to get a clear understanding of (1) the capabilities and limitations of residential air conditioning; (2) the total cost involved, including installation and operating costs; (3) the noise levels resulting from the operation of the equipment; and (4) the relative advantages and disadvantages of a central system as compared with room air conditioners or coolers.

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What are the advantages of modern air conditioning?

There are many advantages in air conditioning for the home. People are demanding higher and higher standards of comfort in everyday living. And control of temperature and humidity, of course, is necessary for comfort during summer months. But the advantages go beyond this. Surveys have shown that, because of better sleeping and eating habits, there is better health in air-conditioned homes and a general lessening of the exhausting effects of summer weather. Housekeeping chores and redecorating costs are less. Potential damage due to mold, mildew and other high-humidity problems is minimized.

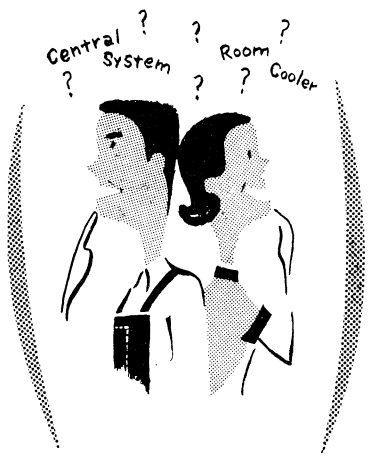
What types of air-conditioning equipment are available to us?

Residential air-conditioning equipment is available for use as individual *room coolers* or as a *central system*. Room air conditioners or coolers usually are mounted in window openings but are also available as floor-console models. In any case, all self-contained room coolers require a sizable opening through an outside wall and either project into the room or out from the exterior wall surface, depending on the design.

Room coolers are self-contained with air-cooled condensers; that is, all the components are contained in the cabinet. Nothing is required but an electric power connection. The heat and humidity removed from the air are rejected directly to the outside air, and this is the reason for the outside air connection.

Central systems use a single refrigeration compressor and a coil-and-fan unit to distribute the conditioned air to the various rooms of the house through a duct system. This type of system is usually installed in conjunction with the warm-air heating system. However, the duct and register requirements are not the same for cooling as for heating. Therefore it's often not advisable to try to install a cooling system in an old warm-air heating system which was not designed with cooling in mind.

There is another type of central air conditioning which hasn't been as widely used to date as the air-handling system. In this type of system, individual convector-type cabinets are placed in the various rooms. Either chilled water or a refrigerant is circulated in pipes from a centrally located refrigeration compressor. The individual



cabinets contain cooling coils and fans for circulating the air. These must have a plumbing connection for carrying away the water condensed from the air. These units don't require an opening through the wall or a window connection.

Central systems may have air-cooled or water-cooled condensing units. If air-cooled, the condensing unit is located outdoors in a weatherproof enclosure having a volume of about 10 cubic feet. If water-cooled, a source of water must be available in quantities of about 2 to 4 gallons per minute, depending on the size of unit. Water-cooled systems can also be equipped with water-conservation devices. These are called water-cooling towers or evaporative condensers, depending on the particular application. These devices use motor-driven fans to draw air through a circulating water spray. The water is cooled by evaporation, and only the evaporated water must be replaced from a water source. This is but a small fraction of the water that would otherwise be used.

The decision as to which of the above combinations of equipment should be used in a particular central-system design should be carefully made — and only after consideration of such factors as availability and cost of water, electric power cost, initial and maintenance cost of the equipment involved, governing codes, etc. The evaluation of these factors should be made only by qualified persons.

Well water temperature in Iowa is cold enough that it can be used directly in cooling coils to do an acceptable cooling job in central systems. In this case, a deep-well pump would be used instead of a compressor. The amount of water required would ordinarily vary from 8 to 16 gallons per minute or perhaps 4 to 5 times as much as that required for condenser cooling purposes. Because of the large quantities of water required during the driest season of the year, direct well water systems are usually ruled out, except in the most favorably situated areas.

Attic fans, window fan units with or without evaporative cooling features, and ordinary warm-air furnaces with summer switches to operate the blower and circulate basement air are not air-conditioning units and should not be considered as such. Any such equipment can be used to get some measure of relief. But they do not have the capability of controlling either temperature or humidity and thus do not meet the requirements of a true air-conditioning system.

If we had the money, should we consider complete, year-round air conditioning for Iowa conditions?

Air conditioning is defined as the simultaneous control of temperature, humidity, purity and movement of the air. Any system or combination of equipment which positively controls the temperature and humidity of air both in summer and winter and — in addition—filters the air and provides circulation without drafts is a year-round air-conditioning system. Such systems are being considered and installed by thousands of Iowa families every year.

Under what conditions would a room air conditioner be the answer?

A room air conditioner is ordinarily used where it is desired to cool a single room, such as a bedroom, at the lowest possible cost. Room air conditioners may also logically be used in rented houses or rooms, or in some existing houses where it is impractical to install a central system.

We believe we might be able to afford one room air conditioner. Where would be the best place to put it?

A single room cooler should be placed in the room where it's most needed. Some people feel that a good night's sleep is most important. Others feel that a single room cooler should be placed in the dining room so the family can eat and enjoy their meals in comfort. Unfortunately, room air conditioners are heavy and bulky and can't be easily moved from room to room.

How can we tell what size room air conditioner to get? Why are sizes given in terms of horsepower?

People with experience in this field can make a rapid survey of a room and accurately specify the size room cooler needed. This must be done either from an architectural plan or from an actual survey of the existing building. *Anything less than this is just a guess, and the resulting installation may be disappointing.*

Experience has shown that water-cooled units used in air-conditioning systems with average coil temperatures require about 1 horsepower to produce 1 ton of refrigeration (the cooling effect produced by melting 1 ton of ice in 24 hours). As a rule of thumb, then, an air-conditioning system with a 3-horsepower unit would be rated at about 3 tons capacity. This rule is misleading, however, when applied to air-cooled units since these require more motor horsepower than units with water-cooled condensers. But the total cost of operation may be no more since no water is required.

What can and what can't room air conditioners do?

Room air conditioners can cool, dehumidify and filter the air in one room of the size usually found in homes. A few models also have provisions for supplying heat on the marginal heating days. Room coolers shouldn't be expected to cool an entire house nor to provide immediate relief when first turned on in a hot room. It takes time to bring temperature and humidity conditions down to the comfort zone. This, of course, assumes that the room cooler has been properly sized in the first place for the particular application.

About what is the general price range for room coolers?

The range is about $300 to $450 for most room units. Occasional bargains can be found in

distress sales, promotional sales and closeout models. The reputation and standing of the manufacturer should be considered as well as the reputation and service facilities of the dealer. Other things being equal, remember that we get about what we pay for.

What about operating costs?

An average operating cost wouldn't mean much because of the wide variation of sizes of systems and operating practices, as well as variations in power and water costs. The cost of operating air-conditioning equipment in most Iowa homes would probably average from 3 to 6 cents per hour for room units and 10 to 15 cents per hour for central systems. Remember that this cost is for *actual operating hours*. For a typical summer day, the total operating time for the compressor may be only 6 to 8 hours.

We already have a central forced-warm-air heating system. Should we, then, consider "complete" air conditioning?

If the existing warm-air heating system was originally designed to accommodate air conditioning at a later time, you are in a favorable position to add the cooling equipment at a minimum cost. Otherwise you may find the existing duct system is too small or that the registers are located improperly or are of the wrong type for satisfactory air conditioning. An exact answer for a specific installation could be given only by an engineer or competent air conditioning dealer with experience with this particular type of application.

What type of cooling system is most practical for the home centrally heated by hot water, steam or radiant heating?

Probably room units. Occasionally an existing house is so arranged that a central system could be installed with a minimum of cutting and patching.

In general, what installation problems should we consider — both for room units and for more complete systems?

For room coolers, the most commonly overlooked requirement is adequate wiring. You'll probably need 208- to 230-volt current, though some of the smaller units can operate on 110 volts. Incidentally, room cooler compressors are now available with high "power-factor" motors. It's desirable to have this kind of equipment, and some city electrical codes are being rewritten to require it. High power-factor motors don't "load up" a wiring system as much as would otherwise be the case. Room coolers should be properly located in a room for good air distribution and carefully fitted and sealed in the window opening. Special models are available for casement windows.

An air-cooled central system condensing unit would be located outdoors near the house in a weatherproof cabinet where air could freely circulate over the condenser surfaces. A water-cooled unit using a water-conservation device would have a water-cooling tower or evaporative condenser probably located outdoors but occasionally located in the basement with connecting duct work to the outside.

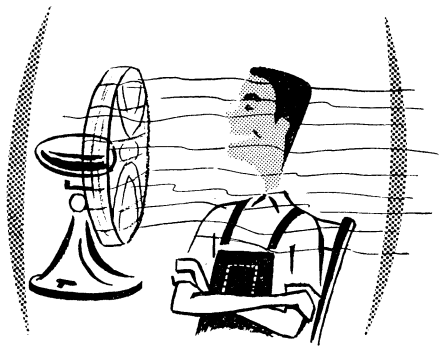
In general, the following rule will apply—motors up to 2 horsepower would be 115-230 volt, single phase; 3 horsepower could be 230 volt, single phase, but preferably 3 phase; and 5-horsepower motors are ordinarily 3 phase. Since 3-phase current usually is not available in farm circuits, this presents a problem. Fortunately most homes can be handled with 3-horsepower units, but if a 5-horsepower, single-phase unit is required, the situation should be investigated very carefully before making any commitments.

We're worried about our water supply. Is there some way to totally air condition our home without having to depend on an adequate water supply?

Yes—by using air-cooled condensing units or by using water-conservation devices with water-cooled condensing units.

We can't afford air conditioning at present. What else can we do to make ourselves more comfortable?

Circulating fans, window fans, attic fans and dehumidifiers can all help to a limited degree. In Iowa the summer night temperatures average about 20 degrees



below the day temperatures. Comfort can often be increased by careful planning in the operation of window shades and open doors and windows to take advantage of the night cooling. Light-colored walls and roofs are noticeably cooler. Insulation always helps.

What about ventilator fans for kitchen, laundry and basement?

Ventilating exhaust fans are very helpful—*if* they're used to carry away heat and water vapor at the source where they're being generated. However, drawing hot and humid outside air through a *basement* in the summer will aggravate an already bad humidity condition. As a result, water may actually run down the cooler walls below grade levels, and rust and mildew may become intolerable at times.

We're not interested in air conditioning at present, but what does the future hold for air conditioning? Are new developments expected which may change the present situation?

Remember that air conditioning is not a new development although the application to residences has become an important market only in recent years. Don't expect any revolutionary developments that would make your present system obsolete. At least one company is doing serious research on a completely electronic air conditioner; that is, one having no mechanically moving parts. This development as a competitive system, however, is a long way off.

Where can I get more information?

Consult a reliable air-conditioning dealer handling well-established lines, or an air-conditioning engineer.